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ABSTRACT

Income predictions that provide some indication of the potential value of attending college are considered. Standard multiple regression analysis of data describing the income experiences of men 25 years old and older were used to determine differences in incomes of high school and college graduates. Information on the gross national product was then added to the income prediction equation for the period 1956 through 1975, and the resulting predictions were improved. Freeman's (1976) three-equation recursive adjustment model is presented and assessed. Based on further studies, it is suggested that the number of high school graduates is the most useful variable, particularly for predicting the income of men, and the second best predictor is birth rate. The economic measures of personal income and disposable personal income are the most useful predictors of the incomes of women high school graduates who do not graduate from college. Other economic and labor market variables such as gross national product per person, percent of the labor force that is unemployed or professional workers are also useful, as are share of population living in urban households, household average size, and higher education income and expenditure statistics. The findings indicate that aptitude and ability scores, enrollment and retention rates, and grades are not useful income predictors. The marginal productivity theory of wages, based on the work of Adam Smith, and Thurow's (1975) job competition theory of wages are addressed. A bibliography is appended. (SW)

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PREDICTORS OF INCOMES*

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Each year millions of high school graduates evaluate programs of study and institutions of higher education, forego substantial current income, and spend billions of dollars to meet tuition and other costs of investing in college and university education. Taxpayers, legislators, governors, members of governing boards, administrators, faculties, alumni, philanthropists, accrediting agents, and many others also evaluate programs and institutions as they make decisions concerning where and how to invest funds, time, and effort. Students and others invest in higher education programs of study and instruction, in part, because they note the high values society places on the products and services of college and university graduates - - values evidenced by relatively high salaries and wages.

Evaluations of programs of study and instruction will become more accurate, and therefore more useful, as increasingly objective methods are developed and applied. The greatest potential for improvement in evaluation seems to lie in rate of return studies which relate the cost of investments to the value of benefits. Benefits are evidenced by the differences between the lifetime incomes of college graduates and those of high school graduates of equal academic aptitude who do not pursue college education. Accurate cost estimates are not difficult to make; the making of accurate predictions of incomes, and income differences, however, is

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This paper was presented at the Twenty-First Annual Forum of the Association for Institutional Research held at the Leamington Hotel in Minneapolis, Minnesota, May 17-20, 1981. This paper was reviewed by the AIR Forum Publications Committee and was judged to be of high quality and of interest to others concerned with the research of higher education. It has therefore been selected to be included in the ERIC Collection of Forum Papers.

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difficult. Indeed, the pioneers in the field - - Walsh, Schultz, and Becker - - implicitely predicted that incomes in the future would be the same as income today.

In 1959, Houthakker departed from that tradition and increased the accuracy of income predictions by incorporating factors describing the growth in the economy. Since that time, Freeman, Smith, Welch, Witmer, and others have suggested other factors that increase the accuracy of predictions of income, but add little to the underlying, explanatory theory.

The prediction that differences in incomes will not change, i.e., that the income differences in a given year are good indicators of income differences in the next year, and in the next year, etc., is basic to the work of Walsh of Harvard, published in 1935. The accuracy of this prediction can be tested by applying standard statistical procedures to data describing actual income differences. Data describing the annual incomes of men 25 years old and older during the period 1956-75 are available from the U. S. Bureau of the Census (1966).

The results of using a standard multiple regression program to study this data describing the income experiences (in 1977 dollars, to offset consumer price inflation) of men 25 years old and older on the assumption that the differences in incomes of high school and college graduates one year predict income differences in the following year and in years following are displayed in REPORT 1. While having such data is infinitely better than having no data at all, our predictions of longitudinal incomes on the basis of cross sectional data are not very accurate.

In 1959 Houthakker increased the accuracy of income predictions by incorporating factors describing the growth of the economy. Adding this measure - - gross national product in the year prior - - to the equation predicting the income differences between male high school and college graduates 25 years old and older during the period 1956 through 1975 yields the much improved results displayed in REPORT 2.

In 1976 Freeman published the following three-equation recursive adjustment model which seemed to hold promise for improving the accuracy of predictions of income differences despite the sensitivities and possible estimation errors

associated with the high levels of auto correlation and colinearity in these data (Smith and Welch):

$$FRSH = -2.02 + .88\ POP^{+} + 1.31\ [CSAL-ASAL] + .21\ FRSH\ [-1]$$
$$(.21) \qquad (.26) \qquad [.16]$$

Coefficient of determination = .987
Standard error of estimate = .049
Durbin-Watson d = 1.79

$$BA = -.63 + .71\ FRSH\ [-4] + .29\ FRSH\ [-5]$$
$$(.20) \qquad (.20)$$

Coefficient of determination = .976
Standard error of estimate = .061
Durbin-Watson d = 0.55

$$CSAL = -2.52 - .15\ BA(-1) + 1.1\ DEM + .31\ ASAL + .45\ CSAL(-1)$$
$$(.02) \qquad (.51) \qquad (.24) \qquad (.11)$$

Coefficient of determination = .994
Standard error of estimate = .018
Durbin-Watson d = 1.51

FRSH = number of first-degree, credit enrolled males.

POP = number of 18 to 19 year old men.

CSAL = a weighted average of college starting salaries (in constant dollars) taken from the annual survey of F. Endicott, "Trends in Employment of College and University Graduates in Business and Industry," (Placement Center, Northwestern University). The weights are .05 for accounting, .35 for engineering, .20 for general business trainees, and .40 for sales.

ASAL = average annual earnings of full time workers.

BA = number of male bachelor's graduates.

DEM = index of demand for college graduates, calculated by taking a fixed-weight index of employment in 46 industries.

Unfortunately, studies revealed that the starting salaries of college graduates represented by CSAL are not good correlates of income differences between male high school and college graduates 25 years old and older during the period 1956 - 75. In five other tests of Freeman's formula

$$FRSH = a+b,\ POP\ \&\ b_2\ (CSAL-ASAL) + b_3\ FRSH\ (-1)^{b}$$

Wish and Hamilton found b_2 (CSAL-ASAL) the <u>least</u> important predictor of FRSH thus reducing the promise of Freeman's work.

Searching for more accurate predictors of income differences, I identified four independent variables which I presented during Session 13G at the 1979 Forum of the Association for Institutional Research in San Diego, California, on 17 May. Ensuing communications and reports from institutional researchers, Smith and Welch, and Freeman (1979) stimulated a continuing search which yielded the better results displayed in REPORT 3 and REPORT 4.

The following specific variables were rejected in the studies underlying REPORTS 3 and 4 because they added less to the prediction than did other variables, were excessively collinear, and/or were not sufficiently significant:

Gross National Product of the United States in hundreds of millions of 1977 dollars, 9 and 10 years prior.

Personal income per capita in 1977 dollars, 9, 10 ...27 years prior.

Disposable income per capita, in 1977 dollars, 9, 10 ...27 years prior.

Average spendable weekly earnings of U.S. workers, in 1977 dollars, 9 years prior.

School enrollment rates of females, in tenths of percents, 9, 10 ...48 years prior.

School enrollment rates of males, in tenths of per cents, 9, 10 ...26, 28 ...48 years prior.

Retention rates: number of persons in grade 13 per 100 who entered grade 5, 9, 10 ...24 years prior.

Sibling overlap at college age, in hundreths (based on Golberg and Anderson) 9 years prior.

Average mental ability of college entrants in mean percentile ranks of entering freshmen (based on Taubman and Wales), 9, 10 ...48 years prior.

American College Test composite score, in tenths, 9 years prior.

Verbal Scholastic Aptitude Test score, 9 years prior.

Mathematics Scholastic Aptitude Test score, 9 years prior.

College grade point average on four point scale, in hundreths, 9 years prior, (based on Suslow and Juola).

United States population of 22 year old males, in thousands, 9, 10 ...17 years prior.

Higher education attainment rate: the number of persons earning bachelors and first professional degrees, divided by the number of 22 year old males, in ten thousands, 9, 10 ...17 years prior.

Freeman's CASL: a weighted average of college monthly starting salaries (in constant 1977 dollars and cents) (taken from the annual survey of Endicott) (the weights are .05 for accounting, .35 for engineering, .20 for general business trainees, and .40 for sales) 9 years prior.

To avoid recursiveness, i.e., prediction based on previous prediction based on previous prediction ..., the following data limits were used in the various studies:

Salary at Age	Most Recent Prior	Earliest Year Prior
25 and older	9	48
29	9	48
39	17	48
49	26	48
59	35	48
69	43	48

In studies of male salaries the number of cases was 22 and the maximum number of independent variables in a single predicting equation was limited to 4. In studies of female salaries the number of cases was 11 and the maximum number of independent variables in a single predicting equation was limited to two. In all studies the colinearity tolerance was preset at .80 while the test of significance was reported as a computed F value and the test of auto-correlation was reported as a computed Durbin-Watson d statistic.

Scholars who usually deal with nonexperimental matters are tempted to say, "Don't trust an observation unless it is confirmed by a good theory and don't trust a multiple regression study unless the results confirm a priori beliefs, i.e., those held independent of observation!" Yielding to such temptation nullifies empiricism - - the induction of knowledge from observation and experience - - and leaves us with rationalism - - the deduction of knowledge from a priori presumptions based on received authority and revelation, i.e., if what we see does not fit our presumptions, we reject what we see! Resisting such temptation facilitates the finding of better predictors. The purpose of these studies was prediction, not the testing of hypotheses, nor the development, explanation, and elucidation of theory. Nonetheless, a few brief summary statements do not seem inappropriate.

In making predictions of income, data describing conditions 48 to 39 years prior are about as useful as data describing conditions 38 to 26 years prior which are more than twice as useful as data describing conditions 25 to 9 years prior, e.g., data describing conditions from 9 to 25 years prior represent one-third of the 11,400 possibilities in the twenty-four studies but yield only one-eighth of the best predictors, one-seventh of all predictors, and one-seventh of a weighted sum of all predictors.

The number of high school graduates is the most useful variable, particularly for predicting the incomes of men. The second best predictor is birth rate.

Declining birth rates and declining numbers of high school graduates predict rising average incomes of male high school graduates ages 59 and 69, male college graduates age 49, and female college graduates age 25 and older. Total declining personal disposable income in the United States predicts rising average incomes of women college graduates age 59. In all of the other nineteen studies increasing birth rates, increasing numbers of high school and college graduates, and increasing size of labor force predict increasing average incomes of persons, male and female, high school and college graduates.[1]

The economic measures of personal income and disposable personal income are the most useful predictors of the incomes of women college graduates while the size of the labor force and the number of baccalaureate and first professional degrees earned by men are outstandingly useful predictors of the incomes of women high school graduates who do not graduate from college.

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[1] This contrasts sharply with Welch's prediction that as age cohort sizes increase, wages will fall; and as age cohort sizes fall, wages will increase and wages of new-entrant college graduates will rise relative to those of workers with less schooling.

Other economic and labor market variables such as gross national product per person, percent of the labor force unemployed, and professional workers as a share of the total labor force are also useful as are share of population living in urban households, household average size, and higher education income and expenditure statistics.

None of the measures of academic aptitude, mental ability, school enrollment rates, retention rates, and student performance[1] are useful in predicting outcomes nor are sibling overlap statistics. Starting salaries of college graduates are not very useful predictors of salaries of men or women, high school or college graduates, at ages 25+, 29, 39, 49, 59, or 69!

These findings support positions taken by Adkins, Easterlin[2] , Hoyt, and Jencks and others emphasizing the importance of demographics, and long term socio-economic change while deprecating the significance of SAT scores and college student grades as portents of the value of college education. None of these scholars, nor anyone else, has yet developed comprehensive theory to unify all of these phenomena, however four limited theories are germane.

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[1] D. E. Rice (Hollingworth, 1916), Gambrill (1922), and other uncounted researchers since have found a relationship between success in college and income later in life the existence of which these findings do not deny. Rather, this and related research (Witmer, 1971) is telling us that other matters, including major program of study, are more useful predictors of subsequent income levels than are measures of success in college.

[2] These studies do not, however, support the zero sum theory that members of very large age cohorts have lower average incomes than do members of very small age cohorts!

The marginal productivity theory of wages, based on the work of Adam Smith, posits the entry of people into the world of work with a set of abilities to compete for jobs and wages on the basis of their productivity. Education is crucial in this competition because it creates abilities and increases people's potential to be productive. Moreover, the theory implies that increases in the educational level of low income workers will have three powerful and beneficial effects: First, education that transforms low ability persons into high ability persons raises their productivity and therefore raises their wages and incomes. Second, it reduces the total supply of low ability workers, a reduction that in turn leads to increases in their wages as fewer people are available to do the menial and distasteful work. Third, it creates an over-supply of high ability workers, and causes their wages to be bid down. The theoretical net result is an increase in total output because of the increase in productivity of better educated workers; a flow of rewards to the meritorious, and a more equal distribution of wages and incomes. What a bright prospect! Indeed, what in the political economy could be better?

The data in columns (e), (f), and (g) REPORT 5 describing the experiences of women in the short period 1967-78 are in consonance with the marginal productivity theory; those in columns (b), (c), and (d) REPORT 5 describing the observed experiences of men in the longer period 1956-78 are not! Reviewing the transition to universal secondary education which has been completed in the United States since World War II we note that: (a) the percentage of 18 year old men earning high school diplomas increased from 49 in 1947 to 74 in 1967 and has fluctuated between 73 and 76 percent each year since; (b) there is a high, positive correlation between the percentage of each cohort graduating from high school and the difference between incomes of elementary and high school graduates, (25 years old and older) ten years later; (c) from 1956 to 1978 the average constant dollar incomes of elementary and high school graduates increased substantially, presumably reflecting the increased productivity flowing from the increased education, but, (d) the distribution of

incomes became more unequal as the incomes of male high school graduates increased from 143 percent of the incomes of male elementary school graduates in 1956 to 162 percent in 1978! This growing gap between the incomes of high school and elementary school graduates was apparent in 1970 when the prediction was made that the same thing would happen to the relationship between average high school and college incomes as the transition to universal higher education takes place and the college degree replaces the high school diploma as an entrance requirement for good employment (Witmer, 1970) (Carbine, 1974).

The transition to universal higher education is sufficiently advanced to yield observations that: (a) the percentage of each age cohort of men earning baccalaureate or first professional degrees increased from 12 in 1947 to 25 in 1967 and has fluctuated between 23 and 33 percent each year since; (b) there is a high, positive correlation between the percentage of each age cohort graduating from college and the difference between incomes of high school and college graduates (25 years old and older) ten years later; (c) from 1956 to 1978 the average constant dollar incomes of high school and college graduates increased substantially, but (d) the distribution of incomes also became more unequal as the incomes of male college graduates increased from 152 percent of high school graduates in 1956 to 157 percent in 1978, according to the predictions in column (d) REPORT 5 will get even more unequal!

In 1975 Thurow described a job competition theory of wages to account for the stubborn and surprising fact that increased education yields increased inequality of incomes. His theory rests on the propensity of employers to reduce labor training costs by hiring the best educated persons available at prevailing rates of pay (equal to or below the value of marginal product) and to increase those rates of pay as the productivity of the firm (not the productivity of the individual person) increases. On the one hand, when larger numbers of better educated persons become available, they are hired for the higher paying jobs first and those with less education are left unemployed longer and eventually take the lower paying jobs. Those with the

least education are unemployed longest and, where minimum wages are set by law above the value of marginal product, the least educated become permanently unemployable. On the other hand when smaller numbers of better educated persons are available, many with less education are employed in high paying jobs and the gap in average incomes gets smaller.

We will observe a major test of these two theories as we pass through periods of high and low enrollment in college during the next twenty years, and should emerge with a better basis for setting social policy on education in the twenty-first century.

Finally, at the Philadelphia meeting, I was challenged to comment on the persistent ratios between the incomes of men and women. Some people theorize that nature, through genetic, hormonal, and physiological characteristics, differentiates women and men forming two almost rigid, very slowly changing castes like those described by Ogbu. Under this theory, activity within the purview of labor market accounting is distinctively subsidiary and supplementary to the outstanding and primary function of women: the bearing of children and the nurturing of family and friends. Thus the fact that money incomes of women are, on average, lower than those of men is neither a surprising nor temporary phenomonen.

Others, like Skoro, theorize that the lower average money incomes of women are based on culture - - human-created values, attitudes, abilities, and behaviors. Under this theory, cultures as generally disparate as those of women and men are disruptive and disfunctional in complex, economic society. However, culture is amenable to great change through education, discipline, and social experience.

The data in columns (h) and (i) of REPORT 5 seem to be in consonance with the nature theory. Nonetheless, those who believe the culture theory are investing substantial time and effort in affirmative action, assertiveness training, math anxiety reduction, and other programs designed to change the sex related cultures. Whether they can be successful, and whether this, in turn, will affect the average incomes of women relative to men remains to be seen.

REPORT 1

Prediction of Income Differences

Between Male High School and College Graduates

25 Years Old and Older 1956-75

Coefficient of determination (R^2)	.5797
Constant term	2699.3672
Standard error of estimate	481.1229

Variable	Regression coefficient (B)	Standard error	Computer t value	Beta
Income differences 1 year prior.	.6459	.1295	4.9859	.7616

Source of variation	Degrees of freedom	Sum of Squares	Mean squares
Attributable to equation	1	57454400.0000	5754400.0000
Deviation from equation (Residual)	18	4166626.0000	231479.2188

The significance level of the F ratio, which is 24.86, lies between .0005 and .0000.

REPORT 2

Prediction of Income Differences

Between Male High School and College Graduates

25 Years Old and Older 1956-75

Coefficient of determination (R^2)	.7667
Constant term	626.3516
Standard error of estimate	368.9951

Variables	Regression coefficient (B)	Std. error of reg. coef.	Computed t value	Beta
Income differences				
1 year prior.	1.0456	.1791	5.8389	.7238
Gross National Product				
1 year prior.	.1880	.0298	6.3177	.7831

Source of variation	Degrees of Freedom	Sum of squares	Mean squares
Attributable to regression	2	7606351.0000	3803175.5000
Deviation from regression (Residual)	17	2314675.0000	136057.3438

The significance level of the F ratio, which is 27.93, lies between .0005 and .0000.

REPORT 3

Prediction of Mean Income, in 1977 dollars,

of Male High School Graduates

25 Years Old and Older, Who Had Income, 1956-77

Coefficient of determination (R^2)	.98031
Adjusted R^2	.97567
Constant term	10017.65
Standard error of estimate	203.04772

Variables	Regression Coefficient(B)	Std. error of reg. coef.	Computed F value	Beta
High school graduates, in thousands, 31 years prior.	5.609372	.20308	762.953	1.03672
Personal income, in hundreds of millions of 1977 dollars, 42 years prior.	-.3019670	.13774	4.806	-.08321
Expenditures for higher education as a share of GNP in tenths of percents, 22 yrs. prior.	-63.01759	30.45589	4.281	-.07564
Personal income, in hundreds of millions of 1977 dollars, 41 years prior.	-.2802451	.13843	4.099	-.07552

Source of variation	Degrees of freedom	Sum of Squares	Mean Squares
Attributable to regression	4	34887430.34246	8721857.58562
Deviation from regression (Residual)	17	700882.43026	41228.37825

The significance level of the F ratio, which is 211.54986, lies between .0005 and .0000.

Durbin-Watson d = 2.19533

REPORT 4

Prediction of Mean Income, in 1977 dollars, of

Male College Graduates

25 Years Old and Older, Who Had Income, 1956-77

Coefficient of determination (R^2)	.96537
Adjusted R^2	.95722
Constant term	13975.01
Standard error of estimate	379.12658

Variables	Regression Coefficient (B)	Std. error of reg. coef.	Computed F value	Beta
High school graduates, in thousands, 31 years prior.	7.578730	.38842	380.711	.99475
Labor force unemployed, in tenths of per cents, 42 years prior.	-4.570381	1.38834	10.837	-.18914
Labor force unemployed, in tenths of per cents, 45 years prior.	6.404756	1.78038	12.941	.18112
Labor force unemployed, in tenths of per cents, 16 years prior.	-5.776434	3.20018	3.258	-.09083

Source of variation	Degrees of freedom	Sum of squares	Mean squares
Attributable to regression	4	68117550.76954	17029387.69239
Deviation from regression (Residual)	17	2443528.32136	143736.96008

The significance level of the F ratio, which is 118.47605, lies between .0005 and .0000.

Durbin-Watson d = 2.33671

REPORT 5

Mean Incomes, in 1977 dollars, of High School and College Graduates 25 Years old or older.

	Men			Women			Ratios	
Year (a)	High School (b)	College (c)	Ratio (c/b=d)	High School (e)	College (f)	Ratio (f/e=g)	High School (e/b=h)	College (f/c=i)
1956	$11,434	$17,377	1.52					
1957	11,119	17,594	1.58					
1958	10,901	17,926	1.64					
1959	11,285	18,593	1.65					
1960	11,575	19,088	1.65					
1961	11,916	19,673	1.65					
1962	12,392	19,451	1.57					
1963	12,845	19,220	1.50					
1964	13,025	19,879	1.53					
1965	13,528	20,934	1.55					
1966	13,849	21,694	1.57					
1967	13,497	21,108	1.56	$5,656	$9,503	1.68	.42	.45
1968	14,047	22,305	1.59	5,725	9,222	1.61	.41	.41
1969	14,441	23,033	1.59	5,796	9,790	1.69	.40	.43
1970	14,182	22,287	1.57	5,802	9,886	1.70	.41	.44
1971	14,167	22,412	1.58	5,853	9,973	1.70	.41	.44
1972	14,951	23,216	1.55	6,106	9,969	1.63	.41	.43
1973	15,133	23,019	1.52	6,056	9,717	1.60	.40	.42
1974	14,312	20,937	1.46	5,809	9,321	1.60	.41	.45
1975	13,762	21,290	1.55	5,743	9,512	1.66	.42	.45
1976	13,743	21,603	1.57	5,900	9,528	1.61	.43	.44
1977	14,017	22,125	1.58	6,063	9,677	1.60	.43	.44
1978	14,074	22,036	1.57	5,734	9,178	1.60	.41	.42
1979*	14,187	23,401	1.65	5,721	9,471	1.66	.40	.40
1980*	14,143	23,150	1.64	5,715	9,267	1.62	.40	.40
1981*	13,979	23,105	1.65	5,449	8,896	1.63	.39	.39
1982*	13,691	23,091	1.69	5,333	8,610	1.61	.39	.37
1983*	13,276	23,592	1.78	5,204	8,561	1.65	.39	.36
1984*	13,049	24,028	1.84	5,097	8,270	1.62	.39	.34
1985*	12,878	24,292	1.89	4,903	7,713	1.57	.38	.32
1986*	13,026	24,495	1.88	4,675	6,706	1.43	.36	.27
1987*	13,373	24,572	1.84	4,502	6,139	1.36	.34	.25
1988*	13,584	24,554	1.81	4,380	6,093	1.39	.32	.25
1989*	13,935	25,004	1.79					
1990*	14,595	26,021	1.78					
1991*	16,054	27,605	1.72					
1992*	15,846	28,475	1.80					
1993*	15,340	28,653	1.87					
1994*	15,611	28,648	1.84					
1995*	17,546	31,208	1.78					

*1956-1978 Observed
1979-1995 Predicted.

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